lepsy) should be considered to have a much lower than average relapse rate. Patients with these epileptic syndromes whose seizures have been controlled for four years should be considered for withdrawal of anticonvulsant therapy.

Certain potentially reversible illnesses may include recurrent seizures as part of their course. For example, metabolic derangements such as nonketotic hyperglycemia and profound hyponatremia may lead to frequent seizures that are difficult to control. Patients with alcoholism may have withdrawal seizures. None of these patients would be considered to have epilepsy, and anticonvulsant medication should be withdrawn when the underlying illness has resolved.

It appears reasonable to attempt withdrawing anticonvulsant therapy from patients, particularly children, whose epilepsy was easily controlled, who have been seizure-free for four years, who have at least average intelligence and normal neurologic function and whose electroencephalogram shows no abnormalities. This approach can be expected to yield the lowest incidence of relapse following withdrawal of medication.

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Neurologic Manifestations of AIDS

THE ACQUIRED immunodeficiency syndrome (AIDS) may be complicated by neurologic dysfunction in 30% to 40% of cases. Neuropathologic abnormalities, however, are found in about 70%; this may reflect the fact that subtle neurologic signs and symptoms may be overlooked in patients with severe systemic illnesses. In about 10% of patients with AIDS, the neurologic syndrome is the initial clinical manifestation. In such cases, herpes zoster radiculitis and aseptic meningitis are the most common harbingers.

Paralleling the nonneurologic effects of AIDS, the neurologic manifestations are most often due to opportunistic infections or malignancy. Meningoencephalitis, which may be acute or chronic, is the most common neurologic syndrome. In nearly 100 reported cases, most with brain abscess formation, *Toxoplasma gondii* has been implicated. About 60 cases of probable viral encephalitis have been reported, and although the specific virus has not always been discerned, both cytomegalovirus and herpes simplex virus have been cultured from the brains of such patients. *Cryptococcus neoformans* meningoencephalitis is third in frequency, with 33 cases reported. Less frequently implicated are other fungi, mycobacteria and spirochetes. Progressive multifocal leukoencephalopathy has also been reported.

Neoplastic involvement of the nervous system has been reported in 26 instances, including cases of primary brain lymphoma, metastatic lymphoma, meningeal lymphomatosis, epidural spinal cord compression and metastatic Kaposi's sarcoma.

Cerebrovascular complications, associated with nonbacterial thrombotic endocarditis, neoplasm and thrombocytopenia, have been reported in nine cases.

Peripheral nervous system complications occur less often (51 cases). These include chronic inflammatory polyneuropathy, distal symmetric neuropathy, cranial neuropathies due to lymphoma or inflammation, herpes zoster radiculitis and polymyositis.

Algorithms have been published for evaluating AIDS cases in which there are nervous system complications. Several caveats are noteworthy: first, toxoplasmosis is not ruled out by a negative computed tomographic scan or by "nondiagnostic" titers. Second, a cryptococcal antigen test may be positive in acellular spinal fluid. Third, herpes simplex encephalitis may be atypical in course and anatomic distribution in patients with AIDS. Last, different brain abscesses in the same patient may be due to different organisms.

Treatment is outlined by Snider and co-workers and Levy and colleagues. Frequent infectious recurrences, especially with *Toxoplasma* and *Cryptococcus*, raise questions about the duration of therapy.

Unfortunately, the overall prognosis is very poor in a patient with AIDS, with or without nervous system dysfunction. However, the nervous system complications themselves are frequently rapidly fatal if not diagnosed and treated; thus, such treatment may improve both quality and quantity of life in a patient who has AIDS.

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Medical Ethical Issues

MODERN RESUSCITATIVE TECHNIQUES, including ventilator support, often produce ethical dilemmas in treatment decisions for patients with two types of severe brain damage: brain death, in which the patient shows a complete loss of all brain functions, both cerebral hemisphere and brain stem; and states of permanent unconsciousness. One example of the latter is a persistent vegetative state in which deep coma evolves over a few days or several weeks into a condition of eyes-open unresponsiveness and sleep-wake cycles. Physicians and patients' families are increasingly questioning the indeterminate use of life-sustaining techniques for patients who are brain dead or who are extremely unlikely to return to cognitive, sapient life. The first group of patients is, by definition, medically and (but for a pronouncement) legally dead in most American states; the second group is very much alive and must be recognized as such.

The 1981 *President's Commission Criteria,* now the nationally accepted and most current standard for the clinical determination of brain death, superseded the 1968 *Harvard Criteria.* Neurologists (or, when appropriate, neurosur-

geons) should be consulted to confirm the diagnosis because conditions that mimic brain death but are often reversible—such as drug and metabolic intoxication, hypothermia and shock—may exist. Once physicians have made a careful determination of brain death, they should discuss the concept with the patient's family and explore the possibility of organ donation, if clinically feasible and otherwise appropriate. After a patient has been pronounced dead, removing the ventilator has no greater ethical or legal significance than stopping any other treatment for a dead patient.

Permanently unconscious patients present a different problem. Legal concerns added to the inherent limitations of neurologic prognoses frequently make physicians hesitate to classify patients as permanently unconscious. After a sufficient period of observation and adequate clinical evaluation, a physician's confidence in the diagnosis of permanent unconsciousness may lead to a favorable response when the patient's family or surrogate (a legally recognized representative of the patient) requests the withdrawal of treatment, thus allowing the patient to die.

These requests create an ethical issue. In 1981, both the Judicial Council of the American Medical Association and the Los Angeles County Medical Association—supported by the Council of the California Medical Association—endorsed the ethical propriety of withdrawing ventilator support from patients in an "irreversible coma" (a state of permanent unconsciousness), so long as the family concurred and the patient had expressed no contrary wish before the neurologic crisis. In 1983, a Presidential Commission urged that patients' families be recognized as primary decision makers in such cases, stating that "the law does not and should not require any particular therapies to be applied or continued, with the exception of basic nursing care that is needed to ensure dignified and respectful treatment of the patient." In addition, a California appellate court dismissed criminal charges against two physicians in a 1983 case involving the discontinuance of both ventilator and fluid support for a deeply comatose patient. The court held that a physician has no duty to continue treatment that will not improve a patient's prognosis for recovery, that has become futile and that offers no reasonable medical benefit to the patient in terms of a return to a "normal, functioning, integrated existence."

Antibiotics, blood products, cardiac drugs, dialysis, pressor agents and ventilators all might be used as life-sustaining treatment for permanently unconscious patients. No logical distinction can be made among these modalities for such patients. When the family or surrogate concurs and when the decision does not conflict with the values of the patient, physicians may ethically withhold or withdraw all such forms of life-sustaining treatment. There is a caution, however. The provision of fluids and nutrition holds a deep emotional and symbolic significance for many professionals and lay persons, who see it as one element of "basic care" for such patients. To withdraw food and fluids may generate extreme controversy and even lead to sanctions.

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Interventional Neuroradiology

INTERVENTIONAL NEURORADIOLOGY has recently become an accepted treatment method for selected cases of brain and head vascular abnormalities. Treatment is carried out endovascularly, generally through an angiography catheter, and may be divided into two basic types: the opening of arteries that are too narrow and the closing of blood vessels that supply hypervascular abnormalities (arteriovenous malformations, arteriovenous fistulae and vascular neoplasms).

Unlike other areas of the body, the end organ (the brain), is unforgiving of careless technique. Introducing either atheromatous or inappropriately placed iatrogenic emboli into its circulation has grave consequences.

Starving hypervascular lesions of the brain and scalp is done by introducing small foreign particles—usually polyvinyl alcohol foam sponge particles, Gelfoam particles or silicone spheres—selectively into the arteries supplying the lesion through percutaneously placed angiography catheters. For arteriovenous malformations of the brain, one depends on the high flow into the lesion to carry the emboli to the correct place. Introducing tissue adhesives via selective intracranial catheterization may also be undertaken, but it is still considered an experimental procedure and is reserved for life-threatening situations. The goal is to control headache, reduce steal symptoms and lessen the likelihood of second or subsequent hemorrhage (this latter point has not been definitely proved and is controversial). Treating scalp arteriovenous malformations is significantly less difficult and is also safer than treating intracranial arteriovenous malformations. One may catheterize the external branches of the carotid artery and, by using direct fluoroscopic real-time visualization of the embolic process, may completely occlude the blood supply to these lesions. A knowledge of the anatomy of the blood supply of the cranial nerves is essential for maximal patient safety. Though meningiomas may be controlled surgically, there appears to be some advantage in preoperative embolization five to seven days before an operation to allow peritumoral edema to regress before the operative intervention.

It is particularly satisfying for a therapist to encounter a traumatic carotid artery to cavernous sinus fistula, as embolic results are excellent. The therapist may guide a small detachable balloon-tipped catheter into the cavernous sinus and then, using real-time fluoroscopic control, gradually inflate the balloon until flow through the fistula has been stopped. The goal of the treatment is to preserve the internal carotid artery. Acceptance of this procedure is now widespread, and few operative approaches are thus done for traumatic arteriovenous fistulae. One expects the development of third, fourth and sixth nerve pareses in from 20% to 30% of patients; the paresis resolves over the course of three to six months.

Grüntzig balloon dilatation of atheromatous vessels has been recently reported as treatment for narrowing of the prox-